

Faster dumping & loading for the 2650

Here are some utility routines which will enable your 2650 system to dump programs, verify and reload them — all at 300 baud and using a binary format. This gives dumping, loading and verifying times roughly one sixth of those using PIPBUG's 110 baud hex format. The routines are intended for storage in a 2708 EPROM along with the utility routines described in March 1979.

by DAVID EDWARDS

Once your 2650 system is up and running, one of the first things you discover is that a lot of your time can be spent waiting while programs are dumped to or read from cassette tape. So naturally, any means of speeding up this process is most welcome.

We have presented 300 baud routines in the past, but these have mainly been intended for use with a PIPBUG format bootstrap loader, rather than to be stored in ROM. They also provided an "autostart" facility, where a program could be arranged to begin executing automatically as soon as it was loaded.

The present author feels that in a small cassette-based system, such as the majority of 2650-based systems current-

already existing in the ROM (see March 1979), and thus minimise the amount of code to be stored; it also ensured that the routines would be ROM compatible.

In fact, the finished routines require only 251 bytes storage, which still leaves a total of 327 bytes unused in the 1k 2708 EPROM. 6 bytes of RAM are required as a scratch pad, at locations X'2FFA to X'2FFF, but this is the same RAM as used by the earlier routines.

The recording format used by the new routines is shown in the diagram. As the routines were intended only for use with cassette tapes, the leader and trailer consist of 10 second periods of continuous mark. Only a single block is used for each dump, and it is nearly im-

possible to separate blocks in a cassette recording (unlike paper tape). In addition, gaps between blocks take up additional time during both dumping and loading.

No provision for autostarting is made. At the end of a load, control is passed back to PIPBUG. A colon (:) is used as the prompt to signify the start of the block.

Two block checking code (BCC) bytes are included. The first one is used to ensure that the start and end addresses are read in correctly from the tape. The second BCC checks for a faulty data byte.

The format used differs from that used by PIPBUG, in that both start and end addresses are specified initially on the recording for the memory area to be dumped. This change was made solely because it suited the existing ROM routines.

The routines are intended to occupy locations X'3DBE to 3EB8, as shown in the listing. However I suggest that you use the hex input routine to load them initially into another area in your RAM (say X'1DBE—1EB8). The PROM programming program given in the February 1979 issue can then be used to store them into the EPROM at the correct addresses.

The first section of the listing, from locations X'3DBE to X'3E01 inclusive are the actual 300 baud input and output routines, called 3IN and 3OUT. These are completely self contained, and are fully relocatable without modifications, as all relative addressing is used. They are written as subroutines, and are equivalent to CIN and COUT of PIPBUG. The calling address for 3OUT is X'3DBE, while that for 3IN is X'3DE4. 3OUT and 3IN can be used to communicate with your terminal at 300 baud. The bit rate is set by the LODI instructions at locations X'3DDB and X'3DDF, and assumes a 1MHz clock rate.

The remainder of the space is occupied by the DUMP, LOAD and VERIFY routines. To dump a program, type G3E02 AAAA BBBB cr, where A is the start address of the memory area to be dumped and B is the end address. The dump will include locations A and B. A ten second blank leader is provided at the start of the dump, with a similar sized trailer. A 4k dump will take just under three minutes.

To verify a tape, rewind it, type G3EA2 cr, and then start the tape. The contents of the tape must still be stored in memory of course, as the verification consists of comparing the data from the tape with the corresponding data still in memory. The program will respond with "OK" if the tape is correct, or "FAULTY" if a BCC or data error is detected.

To load a tape, type G3E53 cr, and

```

3DBE 77 10
3DC2 C2 05 03 74 40 3B 14 52 1A 04 74 40 1B 02 76 40
3DD0 F9 73 33 27 75 40 33 03 75 10 17 04 B5 F3 7E 04
3DE2 E5 F8 7E 17 77 10 05 00 06 03 12 1A 77 3B 70 12
3DF0 1A 72 3B 67 12 44 30 51 61 C1 FA 76 3B 5D 01 75
3E00 10 17 3F 3C 07 3F 3E 43 20 CC 9C FE 04 3A 3B 93
3E10 0D 0F FA 3B 2C 0D 0F FB 3E 27 0D 0F FC 3B 2D 0D
3E20 0F FD 3D 1D 0C 9C FE 3F 3D BE 27 CC 9C FE 2D 8F
3E30 FA 3B 0E 3F 3C 2A 1A 76 7C 9C FE 3F EB 3F 09 9E
3E40 22 3F 02 3D 01 35 E1 17 20 01 06 11 F3 7E F9 7C
3E50 FA 7A 17 3B 26 9C 3D 0E 3E 1C 3B 13 CD 8F FA 3F
3E60 3C 2A 1A 76 3B 9A EC 9C FE 1C 3C F8 1F 3D 0E 3F
3E70 8F C1 3F 02 3D 17 80 CC 9C FE 17 76 40 77 02 3F
3E80 3D E4 E4 3A 93 79 3B 6E 3B 65 CD 0F FA 3D 60 CD
3E90 0F FB 3B 5B CD 0F FC 3B 56 CD 0F FD 3B E2 EC 9C
3EA0 FE 17 3B 57 9C 3D 02 3B 4D 3B 44 FD 0F FA 9C 3D
3EB0 7E 3F 3C 2A 1A 73 1F 3F 64
    
```

Here is a full hex listing of the two 300 baud routines.

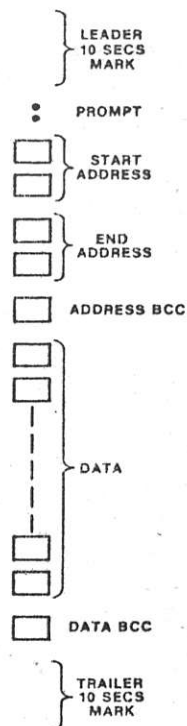
ly in use, an autostart facility is not a great deal of use. This is because many small systems have no easy means of automatically stopping the tape transport once a load has been completed. The tape transport must really be stopped by hand, before the loaded program is started.

For this reason I have chosen to write new routines from scratch, specifically to be stored in an EPROM. This made it possible to use some of the routines

possible to separate blocks in a cassette recording (unlike paper tape). In addition, gaps between blocks take up additional time during both dumping and loading.

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CONDENSED 300 BAUD
BINARY FORMAT

This is the recording format used. All numbers are in binary.

then start the tape. If a BBC error is detected in the addresses read from the tape, the message "FAULTY" will be produced, and the load will stop. Assuming the correct addresses are read from the tape, the load will proceed.

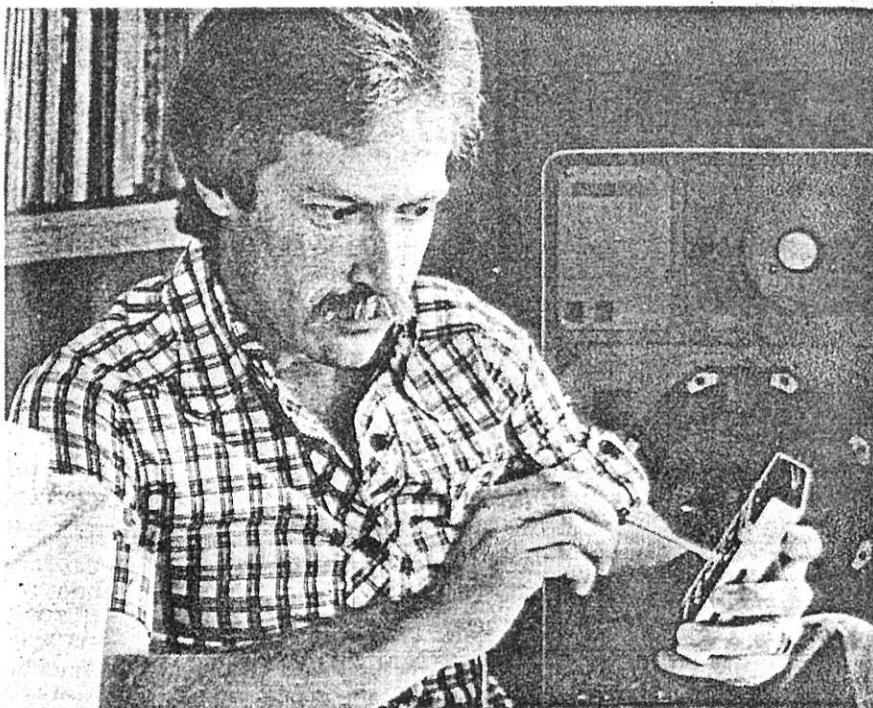
Once the data file has been read in, the data BCC is checked. If the BCC from the tape agrees with the calculated BCC, the message "OK" is printed. A mismatch will produce the message "FAULTY".

I have found the routines to be quite reliable, and have made quite a few 4k memory dumps with complete success. The reduced loading time is very convenient, allowing quite large programs to be reloaded very quickly.

The routines use the PIPBUG routine CBCC, and the existing ROM routines GPAR, FAULTY, OK and INCRT. Only 4 instructions require changes to relocate the program; these are located at addresses X'3E05, 3E27, 3E7F and 3EB6. Other absolute instructions in the programs point to locations in PIPBUG, the RAM buffer area, and the existing ROM.

To burn the programs into your 2708 EPROM, load them into a convenient area of RAM, as well as the PROM program. It is not necessary to reprogram the complete PROM: simply program in the new routines at the correct locations.

Note that in order to allow the routines to operate correctly, it is necessary to disable the monostables on the PROM board when in the read mode, as detailed in the Notes and Errata section of the March 1979 issue.



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